

WHAT IS CLAIMED IS:

1. A filter device comprising:
  - a filter element that has a plurality of  
5 piezoelectric thin-film resonators arranged in series  
arms and parallel arms; and
  - a package that houses the filter element in a  
face-down state,  
the filter element and the package being  
10 electrically connected to each other through bumps,  
the package having a plurality of first pad parts  
on which the bumps are placed, and a plurality of  
transmission paths that electrically connect the first  
pad parts to the outside,
  - 15 the filter element having a plurality of second  
pad parts that are electrically connected to the first  
pad parts through the bumps, and a plurality of wiring  
parts that electrically connect the second pads to the  
piezoelectric thin-film resonators and electrically  
20 connect the piezoelectric thin-film resonators to one  
another, and
  - inductances formed with the transmission paths  
being connected in series to the piezoelectric thin-  
film resonators.
- 25 2. The filter device as claimed in claim 1,  
wherein each of the wiring parts has a thickness  
increased by an addition of a conductive layer.
- 30 3. The filter device as claimed in claim 1,  
wherein each of the second pad parts has a thickness  
increased by an addition of a pad base layer.
- 35 4. The filter device as claimed in claim 3,  
wherein the conductive layers formed on the wiring  
parts connecting the second pad parts to the  
piezoelectric thin-film resonators are integrally

formed with the pad base layers.

5. The filter device as claimed in claim 3,  
wherein the conductive layers formed on the wiring  
5 parts connecting the piezoelectric thin-film resonators  
to one another each has the same layer structure as  
each of the pad base layers.

6. The filter device as claimed in claim 2,  
10 wherein the conductive layers and/or the bump base  
layers each has a double-layered structure.

7. The filter device as claimed in claim 1,  
wherein each of the wiring parts has a length-width  
15 ratio of 3 or smaller.

8. The filter device as claimed in claim 1,  
wherein:  
the piezoelectric thin-film resonators arranged  
20 in series arms are aligned in a row; and  
at least one of the piezoelectric thin-film  
resonators arranged in parallel arms is placed on one  
side of the row of the piezoelectric thin-film  
resonators arranged in series arms, while the other  
25 piezoelectric thin-film resonators arranged in parallel  
arms are placed on the other side of the row.

9. The filter device as claimed in claim 1,  
wherein the area of each of the first pad parts is one  
30 to six times larger than the placement area of each  
corresponding one of the bumps.

10. The filter device as claimed in claim 1,  
wherein each of the first pad parts is connected to  
35 each corresponding one of the second pad parts through  
each corresponding one of the bumps.

11. The filter device as claimed in claim 1,  
wherein the transmission paths are formed on a die-  
attach face of the package.
- 5 12. The filter device as claimed in claim 1,  
wherein at least 80% of the transmission paths are  
formed on regions that do not face regions of the  
filter element in which the wiring parts, the pad parts,  
and the piezoelectric thin-film resonators are formed.
- 10 13. The filter device as claimed in claim 1,  
wherein the package has glass ceramics as a main  
component.
- 15 14. The filter device as claimed in claim 1,  
wherein the line widths of the transmission paths are  
in the range of 50  $\mu\text{m}$  to 150  $\mu\text{m}$ .
- 20 15. The filter device as claimed in claim 1,  
wherein each of the transmission paths has copper or  
silver as a main component.
- 25 16. The filter device as claimed in claim 1,  
wherein each of the transmission paths has at least one  
curved part.
- 30 17. The filter device as claimed in claim 1,  
wherein the filter element has the piezoelectric thin-  
film resonators arranged in a ladder-like fashion.
- 35 18. The filter device as claimed in claim 1,  
wherein the filter element has the piezoelectric thin-  
film resonators arranged in a lattice-like fashion.
19. The filter device as claimed in claim 1,  
wherein the package includes:  
a bottom part that holds the filter element in a

face-down state;

side wall parts that surround the filter element held on the bottom part;

conductive seal rings that are formed over the  
5 side wall parts; and

a conductive cap member that seals a concavity formed by the bottom part and the side wall parts, with the conductive seal rings being interposed.

10 20. The filter device as claimed in claim 1, wherein the package includes:

a bottom part that holds the filter element in a face-down state;

side wall parts that surround the filter element  
15 held on the bottom part;

conductive seal rings that are formed over the side wall parts;

a conductive cap member that seals a concavity formed by the bottom part and the side wall parts, with  
20 the conductive seal rings being interposed; and

vias that penetrate the side wall parts from the bottom part to the conductive seal rings,

the transmission paths being connected to the conductive seal rings through the vias.

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